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Drop Size Spectra for Application of Thuricide 32LV with a Beecomist Atomizer

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Drop Size Spectra for Application of Thuricide 32LV with a Beecomist Atomizer

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PREFACE

The purpose of this wind tunnel test was to establish atomization characteristics of two tank mixes of Thuricide 32LV with the Beecomist[R] spray device at air velocities of 65 mph. Such data are used as input to mathematical models which predict spray coverage, canopy penetration, and off-target drift. Wind tunnel test data also are used to assist in the selection of nozzle types and orientation for specific applications. As an example, for effective use of Thuricide 32LV the volume median diameter should be around 100 μm for application rates under 64 oz/acre. For a given aircraft speed which nozzle size and orientation should be used? Or in the case of rotary nozzles what are the rpm and flowrate settings for the desired drop size range? Wind tunnel tests help to provide these data to achieve specific droplet spectra and application rates.

Funding was provided by USDA Forest Service, Forest Pest Management, Washington Office. Questions and comments should be directed to the Project Officer, John W. Barry, 2810 Chiles Rd., Davis, CA 95616.

Drop Size Spectra for Application of Thuricide 32LV with a Beecomist Atomizer

Drop size spectra were analyzed with sprays containing two different concentrations of Thuricide 32LV and atomized with an electric powered Beecomist unit in a wind tunnel with an airspeed of 65 mph.

Equipment and Methods:

A laser beam droplet measurement system, PMS OAP-2D-GA1 with a PMS 11-C data acquisition system, was used in a 2 x 2 ft wind tunnel to measure the droplet size spectrum. Procedures were similar to previous protocol developed for measurement of rotary atomizers. Briefly the probe was mounted with the laser beam located 5.25 inches above the bottom of the wind tunnel test section and 10 inches downstream from the rear of the rotary cage atomizer. The atomizer was positioned vertically at 6 radial positions representing equal areas (85.28 in^2) of the spray pattern. Droplet size frequency data from each segment was combined into a single composite distribution.

The atomizer was a Model 360A Beecomist unit with a perforated stainless steel sleeve. The flow rate was adjusted to 2.5 gpm by regulating the pressure on a Micronair Variable Restrictor Unit. A Micronair digital flowmeter was used to monitor the flowrate. A DC power supply was used to supply the DC power normally available on aircraft battery-alternator systems.

The Thuricide 32LV material was diluted with the desired amount of water and kept under constant agitation in a stainless steel mix tank during the test period.

Results:

Table 1 lists the calculated flowrate for the specified application parameters.

Table 2 lists the adjustment required for the desired flowrate.

Table 3 lists the summary of the drop size spectrums for the selected test conditions.

Tables 4 and 5 are the detailed drop size frequency tables and graphs for each spray mixture.

Nomenclature:

Diameter with 10% volume < = $D_{V0.1}$

Volume median diameter = VMD = $D_{V0.5}$

Diameter with 90% volume < = $D_{V0.9}$

Number median diameter = NMD = $D_{N0.5}$

$$\text{Relative Span} = \text{R.S.} = \frac{D_{V0.9} - D_{V0.1}}{D_{V0.5}}$$

Table 1

Flowrate Required for an Application Rate of 96 oz/acre and Selected Application Parameters

Airspeed mph	Swath width ft	Total flowrate gpm	No. of spinners No.	Flowrate per spinner gpm
65	100	9.85	4	2.5

Table 2

Adjustments Required for Selected Flowrates

Restrictor	Setting	Pressure	Flowrate
Micronair VRU	11	28 psi	2.5 gpm

Table 3

Drop Size Spectrum with a Beecomist Model 360A Electric Atomizer, Perforated Stainless Steel Sleeve, at 28 volts D.C.

Spray Mixture Part Thuricide:Part Water	Airspeed mph	Flowrate gpm	RPM	$D_{V.1}$ µm	(VMD) $D_{V.5}$ µm	$D_{V.9}$ µm	R.S.
1:1	65	2.5	8700	81	152	234	1.0
1:2	65	2.5	8700	91	156	245	0.98

Table 4

Spray Mixture; 1 part Thuricide: 1 part Water

BEECOMIST,65 MPH,2.5 GPM,8700 RPM,THURICIDE 32LV,50% MIX

DTG 84/06/06 10:40:04

DFM=1.0--2.8 MHz

UPPER LIMIT	N(RAW)	N/SEC	qm/SEC	% N	% VOL.	ACCUMULATED % N	ACCUMULATED % VOL.
56	2770	3.19E 08	10.50	73.49	7.05	73.49	7.05
89	1804	2.95E 07	5.86	6.79	3.94	80.27	10.99
122	2769	3.96E 07	24.07	9.12	16.16	89.40	27.15
154	2728	2.67E 07	36.58	6.15	24.56	95.55	51.71
187	2210	1.23E 07	31.80	2.83	21.35	98.38	73.06
219	1765	4.64E 06	20.28	1.07	13.61	99.44	86.67
252	1420	1.64E 06	11.20	0.38	7.52	99.82	94.19
284	903	594357	5.97	0.14	4.01	99.96	98.20
318	476	144960	2.08	0.03	1.40	99.99	99.60
351	156	25848	0.51	0.01	0.34	100.00	99.94
382	31	2779	0.07	0.00	0.05	100.00	99.99
414	6	654	0.02	0.00	0.01	100.00	100.00
447	0	0	0.00	0.00	0.00	100.00	100.00
TOTALS		4.35E 08	148.94				

TOTAL RAW PARTICLES.... 17038/21961-- 77.58%

NUMBER MEAN DIAMETER... 60.57 MICROMETERS S.D.... 40.40

VOLUME MEAN DIAMETER... 86.86 MICROMETERS S.D.... 120.55

SAUTER MEAN DIAMETER... 123.65 MICROMETERS

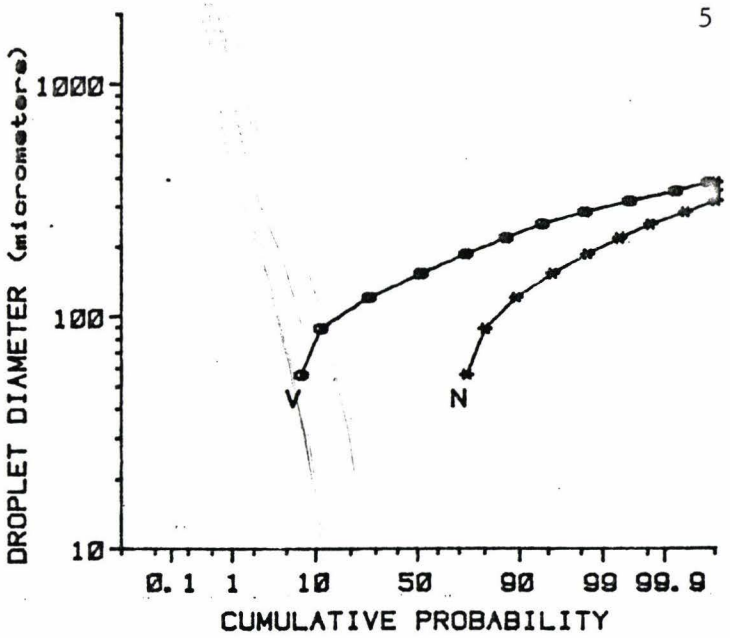
$D_{N0.1}$... 0.00 MICROMETERS $D_{V0.1}$... 81.00 MICROMETERS

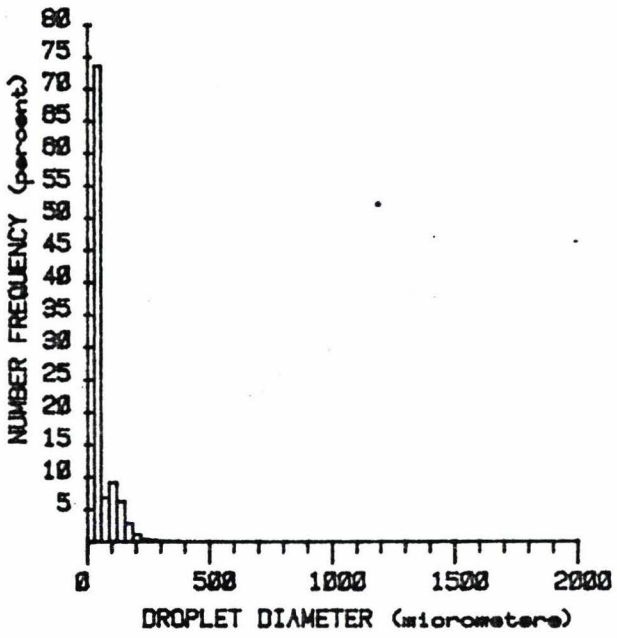
$D_{N0.5}$... 0.00 MICROMETERS $D_{V0.5}$... 152.31 MICROMETERS R.S.... 1.00

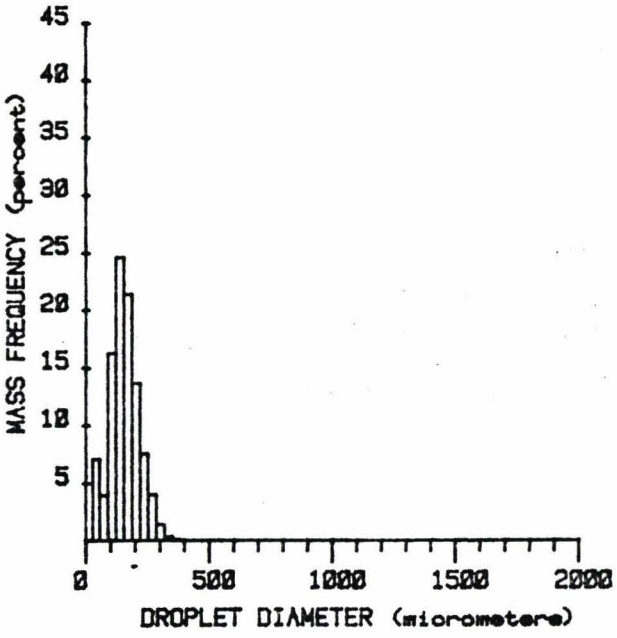
$D_{N0.9}$... 124.84 MICROMETERS $D_{V0.9}$... 234.05 MICROMETERS

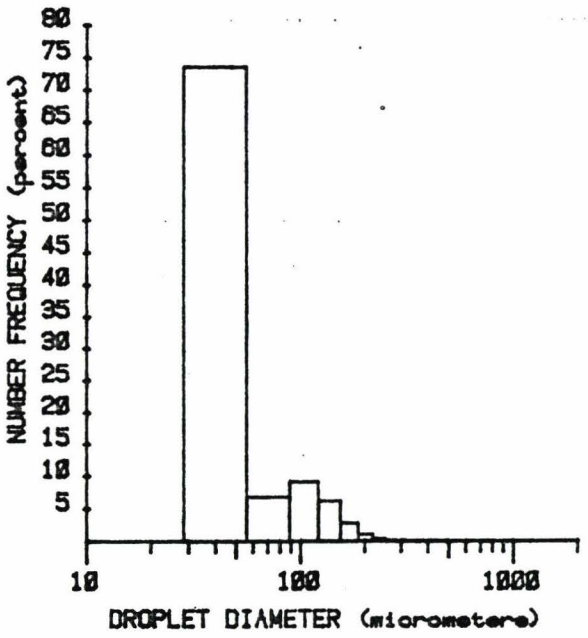
Nozzle Type..... *BEECOMIST*
Nozzle Angle Rel.
to Airstream..... *0°*
Spray Pressure..... *28 PSI*
Airspeed..... *65 MPH*

Distance to Probe... *25 cm.*
Depth of Field..... *1.0 cm.*
Slice Rate..... *2.8 MHz*
Date..... *84/06/06*
Time..... *10:40:04*
File Number..... *10.1.60*









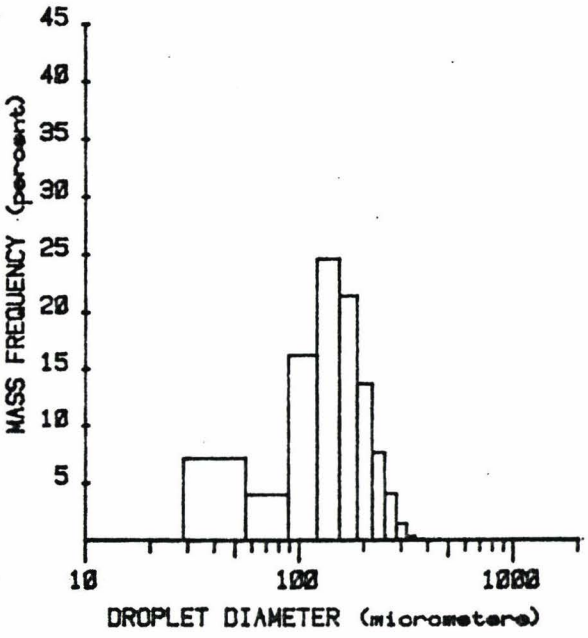


Table 5

Spray Mixture, 1 part Thuricide: 2 part Water

BEECOMIST,65 MPH,2.5 GPM,8700 RPM,THURICIDE 32LV,33% MIX

DTG 84/06/06 14:30:20

DFM=1.0--2.8 MHz

UPPER LIMIT	N(RAW)	N/SEC	qm/SEC	% N	% VOL.	ACCUMULATED % N	ACCUMULATED % VOL.
56	2875	2.94E 08	9.68	70.84	5.80	70.84	5.80
89	1615	2.57E 07	5.11	6.19	3.06	77.03	8.86
122	2520	4.46E 07	27.06	10.72	16.21	87.75	25.07
154	2166	2.87E 07	39.22	6.90	23.50	94.65	48.57
187	2031	1.37E 07	35.61	3.31	21.33	97.96	69.90
219	1690	5.67E 06	24.81	1.37	14.86	99.32	84.76
252	1244	1.67E 06	11.38	0.40	6.82	99.73	91.58
284	860	589659	5.92	0.14	3.55	99.87	95.13
318	371	521692	7.50	0.13	4.49	99.99	99.62
351	99	20972	0.41	0.01	0.25	100.00	99.87
382	25	5611	0.14	0.00	0.09	100.00	99.95
414	13	1744	0.06	0.00	0.03	100.00	99.99
447	1	445	0.02	0.00	0.01	100.00	100.00
479	0	0	0.00	0.00	0.00	100.00	100.00
TOTALS		4.16E 08	166.92				

TOTAL RAW PARTICLES.... 15510/20726-- 74.83%

NUMBER MEAN DIAMETER... 63.56 MICROMETERS S.D.... 43.23

VOLUME MEAN DIAMETER... 91.57 MICROMETERS S.D.... 126.43

SAUTER MEAN DIAMETER... 129.95 MICROMETERS

$D_{N0.1}$... 0.00 MICROMETERS $D_{V0.1}$... 91.25 MICROMETERS

$D_{N0.5}$... 0.00 MICROMETERS $D_{V0.5}$... 156.49 MICROMETERS R.S.... 0.98

$D_{N0.9}$... 132.36 MICROMETERS $D_{V0.9}$... 244.79 MICROMETERS

Nozzle Type..... *BEECOMIST*
Nozzle Angle Rel.
to Airstream..... *0°*
Spray Pressure..... *28 PSI*
Airspeed..... *65 MPH*

Distance to Probe... *25 cm.*
Depth of Field..... *1.0 cm.*
Slice Rate..... *2.8 MHz*
Date..... *84/06/06*
Time..... *14:30:20*
File Number..... *10.1.60*